PATENT
064841-012

Applicant:	Gregory Graham, et al
Serial No.:	09/538,617
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Title:	ARMATURE FOR AN ELECTROMOTIVE DEVICE
Examiner:	G. Perez
Group/Div.:	2834

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Commissioner of Patents
Washington, D.C. 20231

DECLARATION 37 CFR § 1.132

Commissioner:

I, Gregory S. Graham, declare and state as follows:

1. I am a joint inventor and am familiar with the present U.S. Patent application serial number 09/538,617, filed March 29, 2000, entitled ARMATURE FOR AN ELECTROMOTIVE DEVICE, and assigned to G&G Technology, Inc. ("G&G Technology"). I am also familiar with the official Office action dated September 26, 2002, issued therein and with the prior art references cited in the official Office action.

2. I am one of the founders and the chief technology officer for G&G Technology. I am responsible for product development and manufacturing engineering. Prior to forming G&G Technology, I was a senior mechanical design engineer at Miravant Medical Technologies responsible for medical device engineering and manufacturing process development. I have extensive experience in electro-mechanical design engineering, manufacturing and machine tool operations, and am thoroughly familiar with state of the art for electromotive devices. I am named on several patents, issued and pending.

3. I received a Bachelor of Science degree in Industrial Technology from California State Polytechnic University, San Luis Obispo, California, in 1972, including advanced studies in electronics and mechanical engineering.

4. I am aware of many attempts to construct high performance DC coreless motors using printed circuit armatures. Armatures built with printed circuit technology involve rotor windings formed as flexible printed circuits. Printed circuits are circuits in which the conducting material (e.g., copper) is applied to an insulted support base by adhesives and etched from one side. In small motor applications in which the armature wall thickness is tightly controlled, printed circuit techniques result in a small amount of copper in the armature. A small amount of copper in the armature results in a high armature resistance. High armature resistance results in undesirable motor heat and energy dissipation. Therefore, it is desirable to increase the amount of copper in the armature.

5. The amount of copper in a printed circuit armature is limited by a number of factors. One of the most pronounced factors is the printed circuit process itself. This limitation will be illustrated with reference to the FIG. 1 attached to this Declaration as Exhibit A. FIG. 1 provides an accurate representation of the printed circuit armature described in U.S. Patent No. 3,209,187 by Angele ("the Angele patent"). The Angele patent describes a multi-layered armature configuration wherein electrical conductors are printed on both sides of a plastic or epoxy insulating base, and then an adhesive is applied between the electrical conductors. For the purposes of illustration, the printed circuit process will be described with reference to the upper surface of the insulating base with the understanding the same printed circuit process is also applied to the underside.

6. FIG. 1 shows an insulating base of plastic or epoxy coated with a conductive material such as copper on its upper surface. A mask is then placed over the conductive material to create a conductor pattern through an etching process. The portion of the copper material which is not protected by the mask is etched away. As can be seen from FIG. 1, the etching process penetrates the copper material in omni-directional way, eating away at the cooper under the mask as it makes its way downward toward the insulating base. As a result, the etch width will increase with the thickness of the conductive material. In fact, through my many years of experience in this area, I have determined that the etch width can be represented as a ratio equal

to 1.8 times the material thickness. This results in an etch width of .009 inches and a conductor width of .005 inches for a conductive material having a .005 inch thickness and etched using a mask having apertures spaced apart by .014 inches.

7. We have developed an armature that represents a significant departure from conventional printed circuit techniques. Specifically, a non-layered armature construction is provided which allows more conductor to be packed in the armature. In contrast to the layered armature construction of Angele our armature comprises electrical conductors encapsulated in a homogeneous or non-layered material. The electrical conductors in our configuration have a higher concentration of copper because they can be etched from both sides.

8. The etching process in our armature will be illustrated with reference to FIG. 2 attached as Exhibit B to this Declaration. Because the electrical conductors in our armature may be formed from a sheet (as opposed to a material coated onto an insulating base), it can be masked on both sides, and therefore, etched from both sides. I have personally built many armatures using this technique, and have found that for two sided etching, the etching width ratio is 1.1 times the material thickness. This results in an etch width of .0055 inches and a conductor width of .0088 inches for a conducting material having a .005 inch thickness and etched using a mask having apertures spaced apart by .014 inches.

9. The layered construction of a printed circuit armature, such as the armature disclosed by the Angele patent, limits the electrical conductor width due to an etching process that can be performed from only one side with an etch width ratio of 1.8 times the material thickness. Our armature, on the other hand, with a homogeneous or non-layed material encapsulating the conductors enables a two sided etching process with an etch ratio of 1.1 times the material thickness. The result being a 64% increase in conductor width with our armature construction. This increase in conductor width, which cannot be obtained with the printed circuit construction disclosed in the Angele patent, results in higher copper concentration in the armature. Higher copper concentration results in reduced armature resistance, and therefore, a more efficient motor.

I declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are

punishable by fine or imprisonment, or both, under § 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Executed this 25 day of March, 2003.

By: Gregory S. Graham

Gregory S. Graham

Angele
Etching from One side

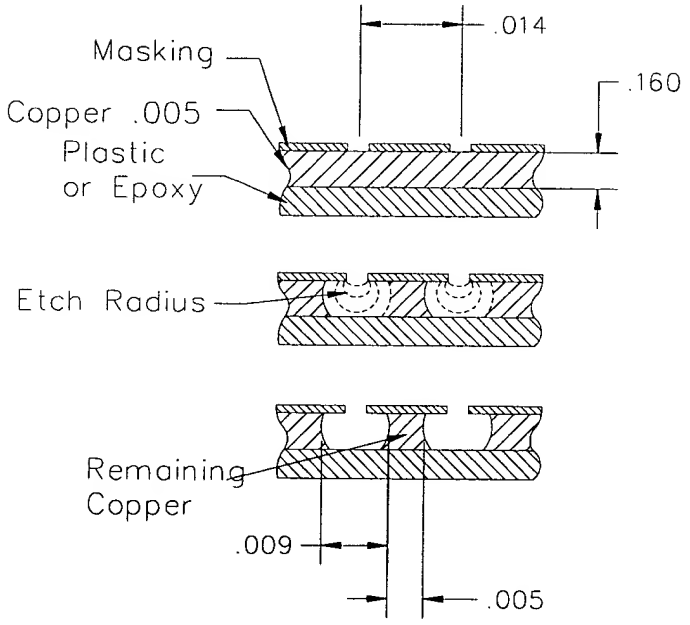

Fig. 1

Our Armature
Etching from Two sides

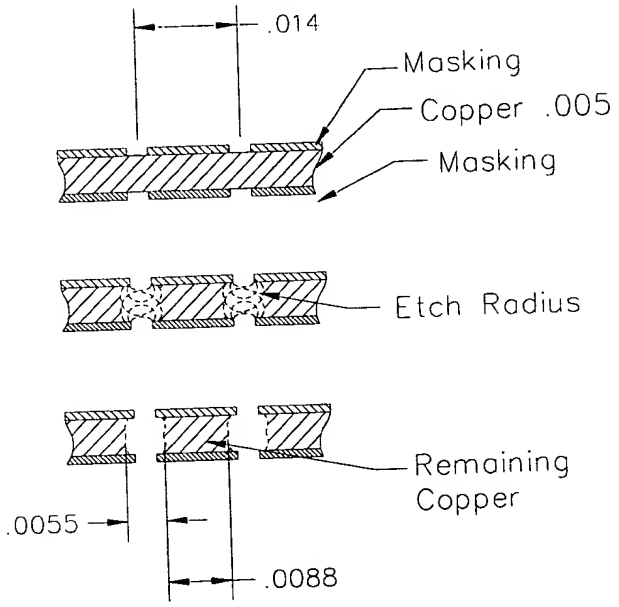

Fig. 2